Electronic Supplementary Material (ESI) for Catalysis Science & Technology.

ESI

Ru/TiO_2-catalysed hydrogenation of xylose: the role of crystal structure of the support

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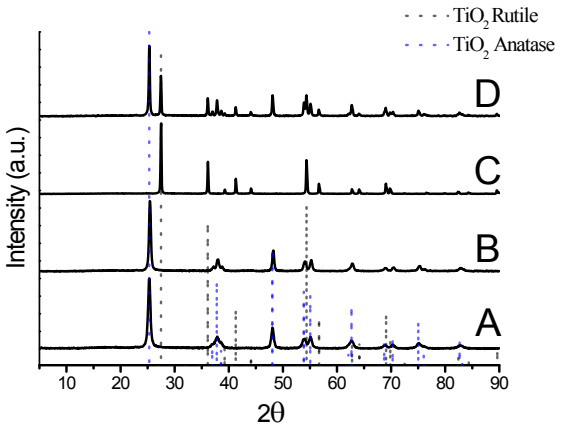


Figure S1. XRD patterns of the supports **A**–**D**.

Phase percent composition was determined by XRD using the following equation:

$$\%Rutile = \frac{1}{\left(\frac{A}{R} \times 0.884\right) + 1} \times 100$$

where A is the area of anatase major peak (2θ=25°), R the area of rutile major peak (2θ=28°) and 0.884 is a scattering coefficient [1].

Table S1: Product distribution at different reaction temperatures with each catalyst.

Catalysts	Temperature (°C)	% Conversion	%Yield					
			Xylitol	Arabitol	Adonitol	Furfural	Glycols	NI
A	120	70.7	10.4	2.3	0.0	1.4	17.4	39.3
	140	92.6	7.1	0.0	0.0	3.1	27.1	55.3
	160	95.6	4.6	3.0	0.0	5.9	43.0	39.1

B	120	84.9	65.2	0.9	2.3	0.0	6.7	9.8
	140	97.4	43.9	2.5	0.0	1.7	27.7	21.6
	160	96.9	34.1	0.9	0.0	0.0	34.9	26.9
C	120	100.0	93.6	5.4	0.9	0.0	0.0	0.0
	140	100.0	85.2	10.0	4.8	0.0	0.0	0.0
	160	100.0	70.8	16.0	6.8	0.0	0.0	6.4
D	120	100.0	95.5	2.5	2.0	0.0	0.0	0.0
	140	100.0	87.8	7.5	4.7	0.0	0.0	0.0
	160	100.0	72.2	18.8	9.0	0.0	0.0	0.0

NI: not identified.

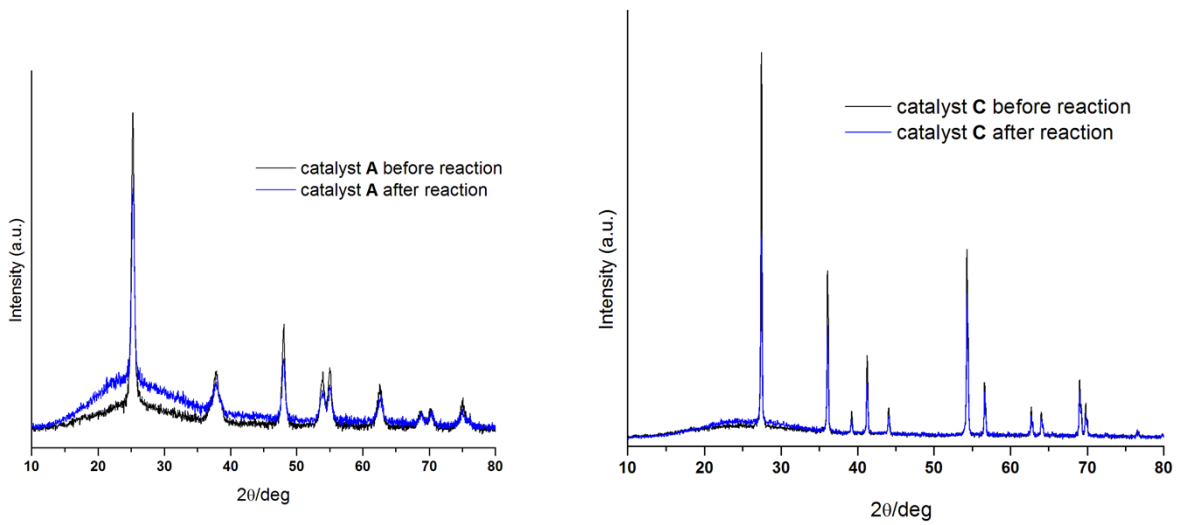
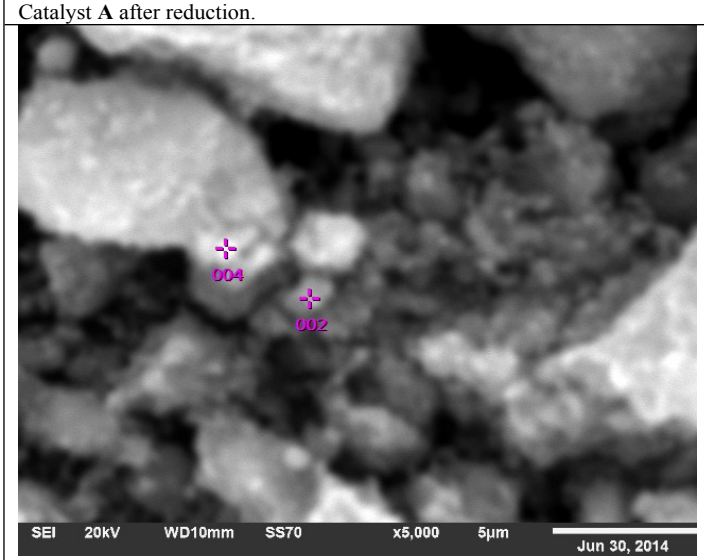


Fig. S2: XRD patterns of the catalysts **A** and **C** before and after reaction

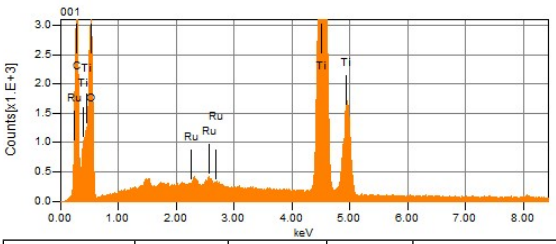
SEM and EDX analysis.

Catalyst **A** after reduction.



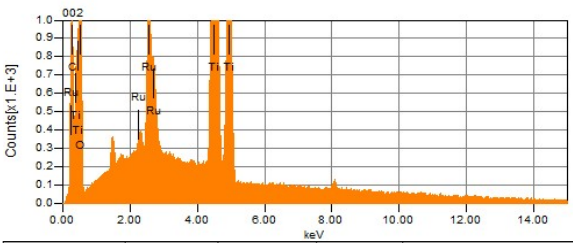
EDX analysis

Full analysis



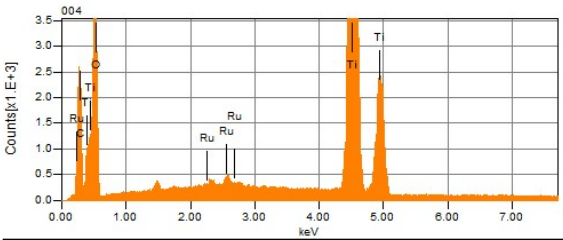
Chemical formula	mass%	Atom%	Sigma	Net K ratio Line
C	24.75	40.06	0.02	967350.0396576K
O	36.50	44.34	0.10	791900.1102546K
Ti	38.18	15.49	0.06	6880650.708781K
Ru*	0.57	0.11	0.02	102360.0091798L
Total	100.00	100.00		

Spot analysis 002



Chemical formula	mass%	Atom%	Sigma	Net K ratio Line
C	9.36	19.78	0.01	309230.0126773K
O	31.91	50.62	0.11	540770.0752899K
Ti	53.28	28.23	0.07	8610540.8869790K
Ru*	5.44	1.37	0.04	877190.0786648L
Total	100.00	100.00		

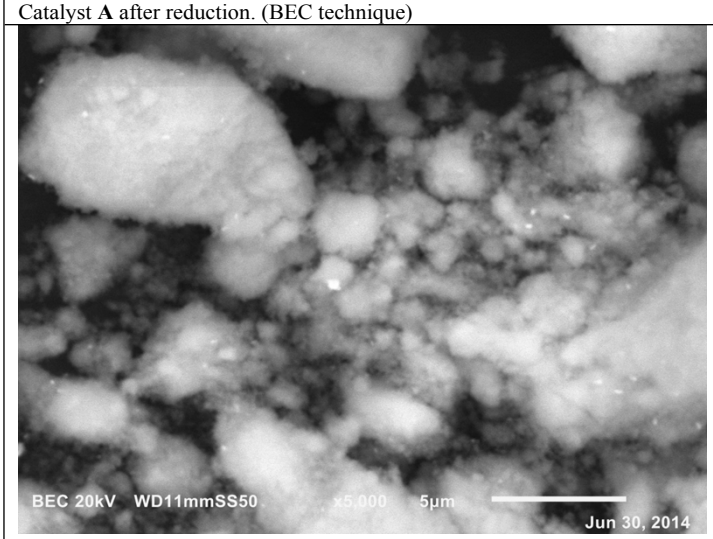
Spot analysis 004



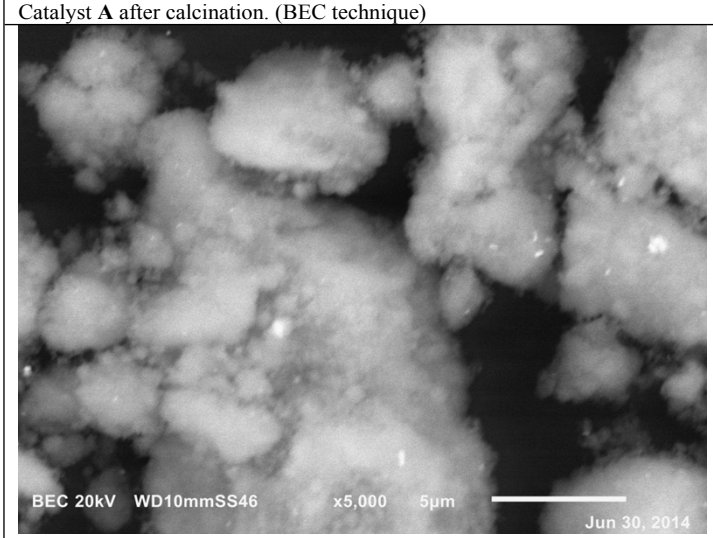
Chemical formula	mass%	Atom%	Sigma	Net K ratio Line
C	13.86	24.83	0.01	624330.0255950K

O	40.83	54.92	0.09	1114280.1551384K
Ti	44.86	20.15	0.05	10068201.037133K
Ru*	0.46	0.10	0.02	102040.0091511L
Total	100.00	100.00		

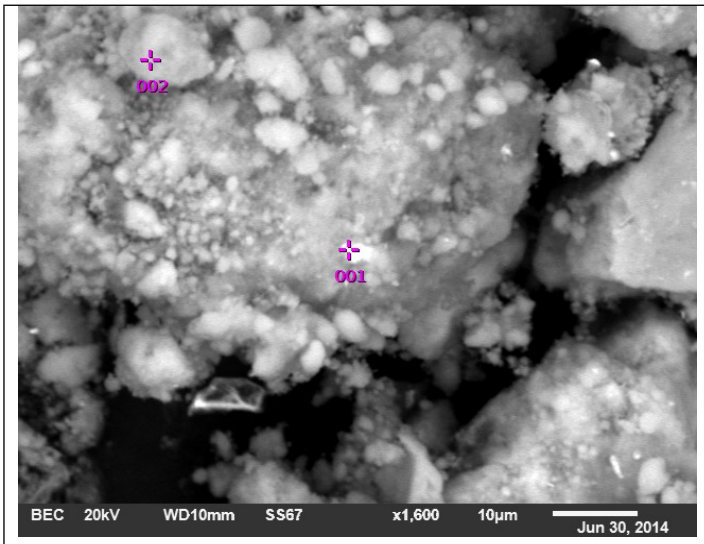
Catalyst **A** after reduction. (BEC technique)



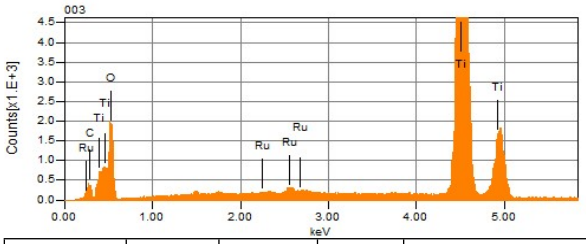
Catalyst **A** after calcination. (BEC technique)



Catalyst **B** after reduction. (BEC technique)

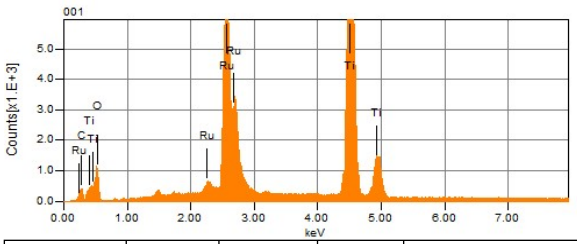


Full analysis.



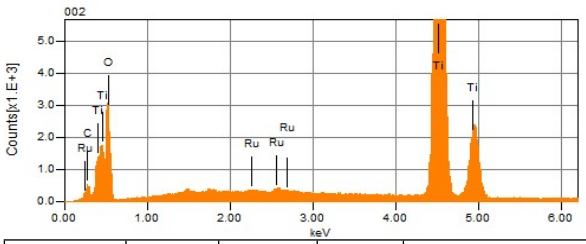
Chemical formula	mass%	Atom%	Sigma	Net K ratio Line
C	4.21	9.07	0.01	95370.0039100K
O	36.50	59.10	0.13	465840.0648572K
Ti	58.45	31.61	0.08	7013470.7224636K
Ru*	0.84	0.22	0.03	98850.0088642L
Total	100.00	100.00		

Spot analysis 001



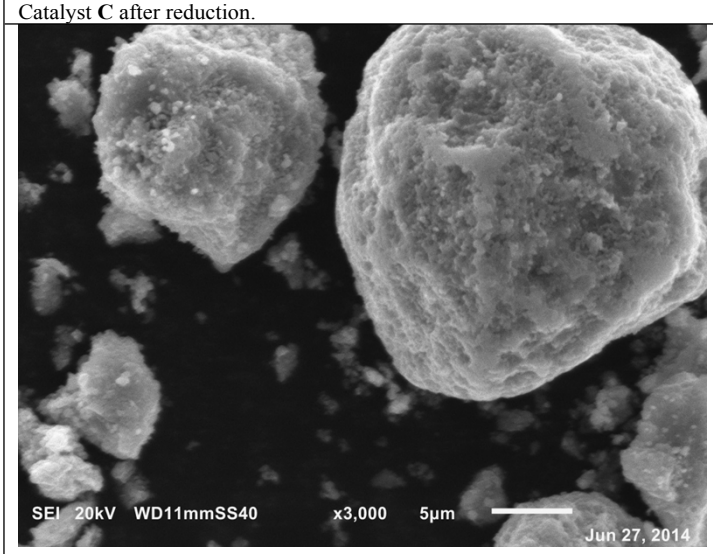
Chemical formula	mass%	Atom%	Sigma	Net K ratio Line
C	2.40	7.68	0.01	80600.0035619K
O	18.32	43.92	0.09	246520.0369980K
Ti	43.49	34.82	0.07	5295040.5879768K
Ru*	35.79	13.58	0.10	4707260.4550520L
Total	100.00	100.00		

Spot analysis 002

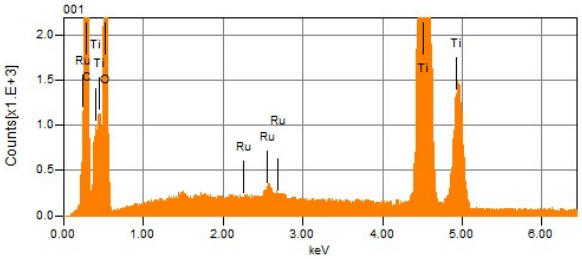


Chemical formula	mass%	Atom%	Sigma	Net K ratio Line
C	3.43	7.31	0.01	105430.0043222K
O	38.75	61.94	0.12	696750.0970074K
Ti	57.39	30.64	0.07	9399680.9682691K
Ru*	0.43	0.11	0.03	6880 0.0061696 L
Total	100.00	100.00		

Catalyst **C** after reduction.

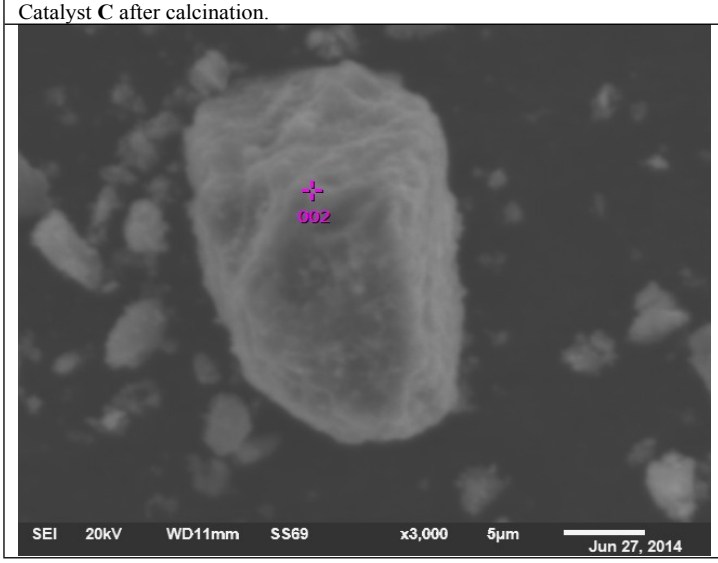


Full analysis.

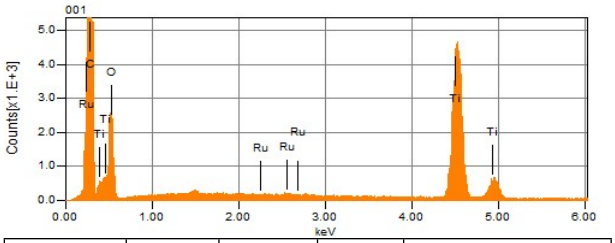


Chemical formula	mass%	Atom%	Sigma	Net K ratio Line
C	30.36	46.71	0.02	1181960.0484557K
O	34.49	39.84	0.10	714220.0994393K
Ti	34.62	13.35	0.05	5948970.6128085K
Ru*	0.54	0.10	0.02	92760.0083185L
Total	100.00	100.00		

Catalyst **C** after calcination.

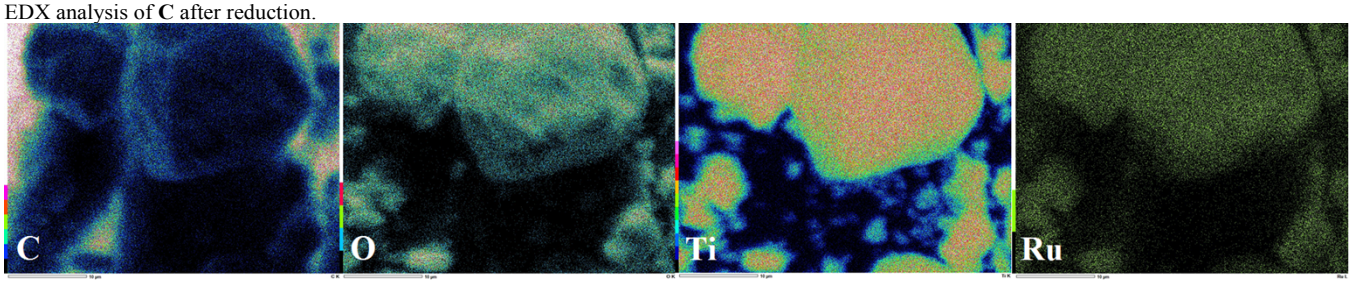


Full analysis.



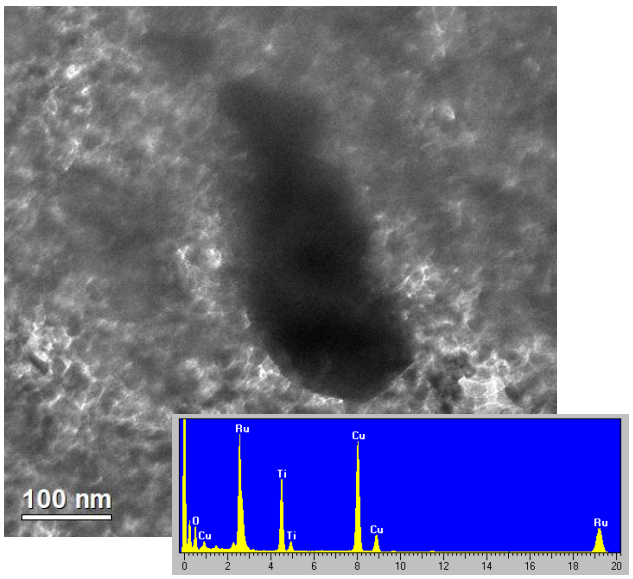
Chemical formula	mass%	Atom%	Sigma	Net K ratio Line
C	65.61	76.82	0.02	4612990.1891149K
O	22.41	19.70	0.07	612570.0852865K
Ti	11.75	3.45	0.03	2545440.2622085K
Ru*	0.24	0.03	0.01	54820.0049159L
Total	100.00	100.00		

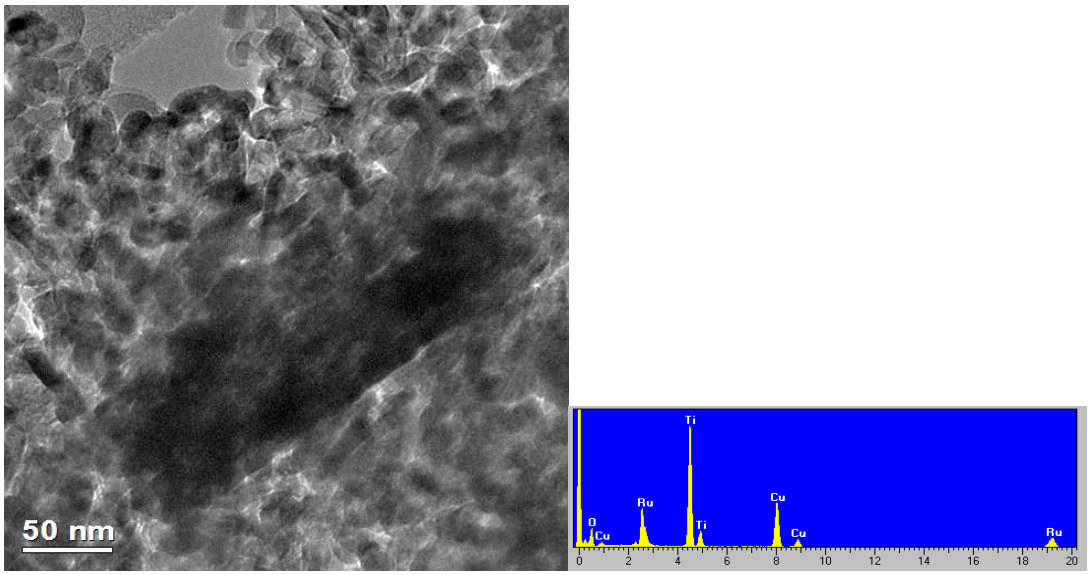
EDX analysis of **C** after reduction.



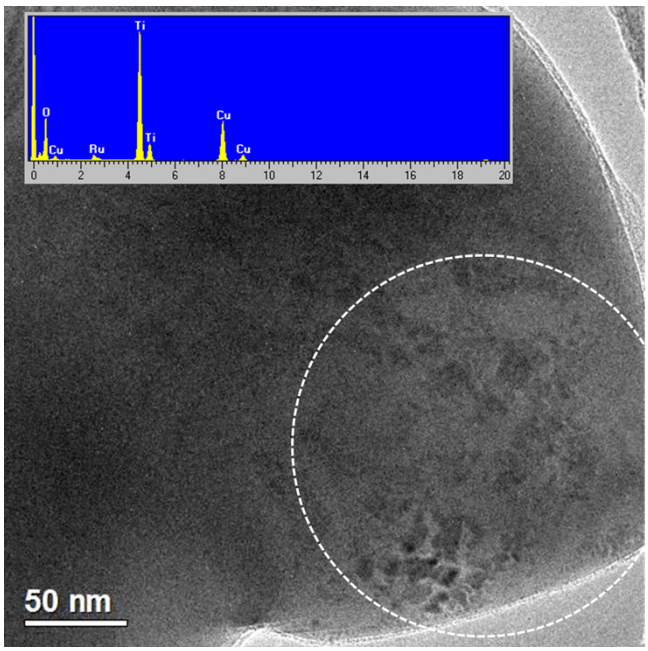
TEM analysis of spent samples

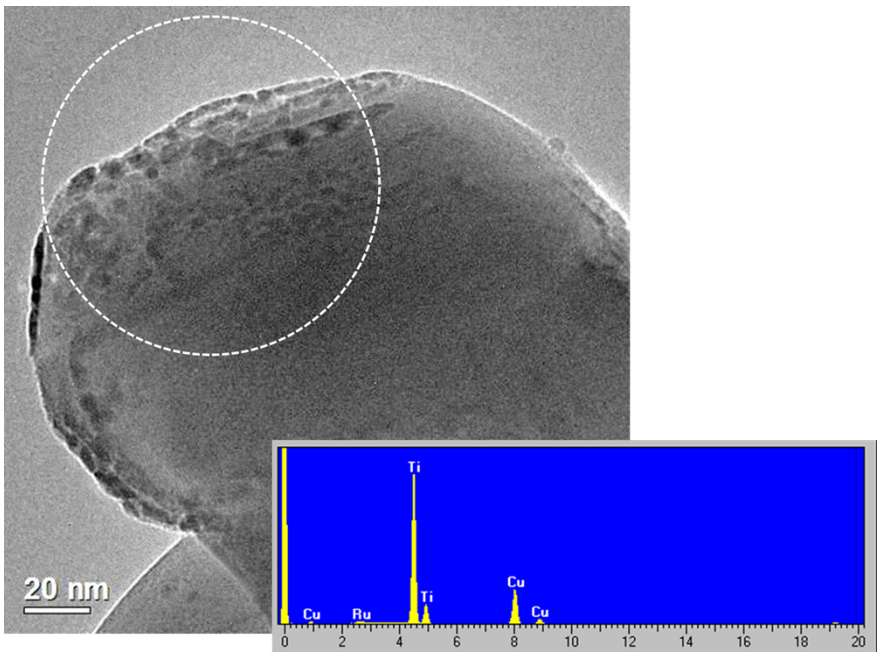
TEM images of two different regions of spent catalyst **A**. Corresponding EDX spectra were collected only from the dark contrasted Ru rich regions.





TEM images of two different regions of spent catalyst **C**.
EDX spectra from the selected areas (circled) show that Ru particles are small and highly dispersed after the reaction also.





1. X. Z. Fu, L. A. Clark, Q. Yang and M. A. Anderson, *Environmental Science & Technology*, 1996, 30, 647-653.

